WHAT IS CLAIMED IS:

1. An information recording apparatus for recording multi-leveled information in a phase-change recording medium by the application of a laser beam thereto, comprising:

power level modification means for modifying a power level of said laser beam into two or more power levels so as to correspond to said multi-leveled information, and setting a plurality of recording mark units including therein at least one recording mark to be formed, based on said modified power levels, so as to correspond to said multi-leveled information.

2. The information recording apparatus as claimed in Claim 1, wherein each of said recording mark units has a power level that corresponds to the total area of said one or more recording marks included in each of said recording mark units.

3. The information recording apparatus as claimed in Claim 1, wherein each of said recording mark units includes one recording mark and has a track-direction length in a range of 0.5 to 1.0 times a beam diameter

defined by $1/e^2$, and the area of said recording mark in each of said recording mark units is changed for recording said multi-leveled information.

Subpart Cont

4. An information reproducing apparatus for reproducing multi-leveled information recorded in a phase-change recording medium in the form of recording marks by the application of a recording laser beam thereto, by the application of a reproducing laser beam thereto, comprising:

reproducing means for reproducing said recording marks based on reference clock signals, with the timing of detecting a mark edge of each of said recording marks and the timing of detecting the intensity of a reflection light from each of said recording marks being made different.

5. The information reproducing apparatus as claimed in Claim 4, wherein said reproducing laser beam has a smaller beam diameter than a beam diameter of said recording laser beam in terms of a beam diameter defined by $1/e^2$.

Subm Cont

6. An information recording and reproducing apparatus for recording multi-leveled information in a phase-change recording medium by the application of a recording laser beam thereto, reproducing multi-leveled information recorded in a phase-change recording medium by the application of a reproducing laser beam thereto, comprising:

power level modification means for modifying a power level of said recording laser beam into two or more power levels so as to correspond to said multi-leveled information, and setting a plurality of recording mark units including therein at least one recording mark to be formed, based on said modified power levels, so as to correspond to said multi-leveled information, and

reproducing means for reproducing said recording marks based on reference clock signals, with the timing of detecting a mark edge of each of said recording marks and the timing of detecting a reflection light intensity of each of said recording marks being made different.

7. The information recording and reproducing apparatus as claimed in Claim 6, wherein each of said recording mark units has a power level that corresponds

to the total area of said one or more recording marks included in each of said recording mark units.

Subby Cont

8. The information recording and reproducing apparatus as claimed in Claim 6, wherein each of said recording mark units includes one recording mark and has a track-direction length in a range of 0.5 to 1.0 times a beam diameter defined by $1/e^2$, and the area of said recording mark in each of said recording mark units is changed for recording said information.

9. The information recording and reproducing apparatus as claimed in Claim 6, wherein said reproducing laser beam has a smaller beam diameter than a beam diameter of said recording laser beam in terms of a beam diameter defined by $1/e^2$.

10. An information recording method for recording multi-leveled information in a phase-change recording medium by the application of a laser beam thereto, comprising the steps of:

modifying a power level of said laser beam into two or more power levels so as to correspond to said multi-

leveled information, and

setting a plurality of recording mark units including therein at least one recording mark to be formed, based on said modified power levels, so as to correspond to said multi-leveled information.

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11. The information recording method as claimed in Claim 10, wherein each of said recording mark units has a power level that corresponds to the total area of said one or more recording marks included in each of said recording mark units.

12. The information recording method as claimed in Claim 10, wherein each of said recording mark units includes one recording mark and has a track-direction length in a range of 0.5 to 1.0 times a beam diameter defined by $1/e^2$, and the area of said recording mark in each of said recording mark units is changed for recording said multi-leveled information.

13. The information recording method as claimed in Claim 10, wherein in modifying said power level of said laser beam, at least one of said power levels is further

changed in a level retention time thereof so as to correspond to said multi-leveled information.

14. The information recording method as claimed in Claim 10, wherein said power level of said laser beam is modified into three power levels, a recording power level, an erasing power level and a bias power level, with the respective power levels thereof being set in a decreasing order of said recording power level, said erasing power level, and said bias power level (said recording power level> said erasing power level > said bias power level).

15. The information recording method as claimed in Claim 14, wherein in modifying said power level of said laser beam, at least one of said recording power level or said bias power level is further changed in a power level retention time thereof in accordance with said multi-leveled information.

16. An information reproducing method for reproducing multi-leveled information recorded in a phase-change recording medium in the form of recording marks by the application of a recording laser beam

thereto, by the application of a reproducing laser beam thereto, comprising the step:

reproducing said recording marks based on reference clock signals, with the timing of detecting a mark edge of each of said recording marks and the timing of detecting a reflection light intensity of each of said recording marks being made different.

17. The information reproducing method as claimed in Claim 16, wherein said reproducing laser beam has a smaller beam diameter than a beam diameter of said recording laser beam in terms of a beam diameter defined by $1/e^2$.

18. An information recording and reproducing method for recording multi-leveled information in a phase-change recording medium by the application of a recording laser beam thereto, and reproducing multi-leveled information recorded in a phase-change recording medium by the application of a reproducing laser beam thereto, comprising steps:

modifying a power level of said recording laser beam into two or more power levels so as to correspond to said

multi-leveled information,

setting a plurality of recording mark units including therein at least one recording mark to be formed, based on said modified power levels, so as to correspond to said multi-leveled information, and

reproducing said recording marks based on reference clock signals, with the timing of detecting a mark edge of each of said recording marks and the timing of detecting a reflection light intensity of each of said recording marks being made different.

19. The information recording and reproducing method as claimed in Claim 17, wherein each of said recording mark units has a power level that corresponds to the total area of said one or more recording marks included in each of said recording mark units.

20. The information recording and reproducing method as claimed in Claim 18, wherein each of said recording mark units includes one recording mark and has a track-direction length in a range of 0.5 to 1.0 times a beam diameter defined by $1/e^2$, and the area of said recording mark in each of said recording mark units is changed for

recording said information.

21. The information recording and reproducing method as claimed in Claim 18, wherein said reproducing laser beam has a smaller beam diameter than a beam diameter of said recording laser beam in terms of a beam diameter defined by $1/e^2$.

22. A phase-change recording medium comprising a recording layer in which multi-leveled information can be recorded by an information recording method for recording multi-leveled information in a phase-change recording medium by the application of a laser beam thereto, comprising the steps of:

modifying a power level of said laser beam into two or more power levels so as to correspond to said multi-leveled information, and setting a plurality of recording mark units including therein at least one recording mark to be formed, based on said modified power levels, so as to correspond to said multi-leveled information.

23. The phase-change recording medium as claimed in Claim 22, wherein said recording layer comprises Sb and

Te with a Sb/Te content ratio of 2 to 5 in terms of atomic %, and at least one element selected from the group consisting of Ag, In, Ge, Ga, B, Si, and Al.